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Disrupted distance learning: the impact of Covid-19 on study habits of distance learning university students

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ABSTRACT

Despite a growing body of work on understanding how students perceived the impacts of the Covid-19 pandemic, the effects on existing distance learning universities have received less attention. This study aimed to understand changes in distance learning students' study habits (learning, assessment and social activities) and assess the factors associated with negative impacts. An online survey collected information on demographics, study-related information, Covid-19 personal circumstances and changes in study habits from 555 undergraduate students at The Open University, UK. Of the study population, an average of 36% reported negative impacts on their study activities and 15% positive impacts. Logistic regression analysis *(n = 269)* demonstrated that negative impacts on study habits overall were associated with difficulties in managing workload and limited interaction with other students. Other factors, such as socioeconomic background, study level, limited interaction with tutors, age, personal health, employment issues, and childcare and caring responsibilities, relate to particular study habits. Our findings have implications for how universities with new and existing distance learning practices address these factors and better support ongoing learning activity during Covid-19 and other similar disruptions.

KEYWORDS

Covid-19; distance learning; study habits; higher education; university students

1. Introduction

This article has been written in the midst of the ongoing Covid-19 pandemic that first began to impact higher education (HE) teaching and learning early in 2020. This crisis has impacted HE institutions (HEIs) (Jayasuriya, 2020; Jena, 2020; Korn et al., 2020). Campus-based universities have had to rethink and reappraise how they deliver effective learning using digital and online technologies following physical restrictions, campus closures and restrictions on student travel. However, the pandemic has also affected and necessarily reshaped the study, work and social lives of distance learning students.

Distance learners (students studying without physically attending college or university) are on average older, and a greater portion belongs to more 'at risk' groups who may be disproportionately affected by the social distancing, health impacts, lockdown and shielding practices being implemented by national governments (World Health Organization

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(WHO), 2020). Distance learners have specific and established ways of using learning technologies, such as mobile devices (Cross et al., 2019), but these ways of studying may also have been affected by the pandemic. Furthermore, distance learning universities will not have been impervious to the impact of physical restrictions because most still relied on some activities requiring physical co-location. These activities include examinations or similar assessments, where high levels of trust and authentication are required and widespread roll-out of technological alternatives remains problematic (Whitelock et al., 2020). Although the main learning activities of distance learning students have not changed, we appreciate that there are slight changes to some of their study-related activities and personal lives. Acknowledging the potential impact of the Covid-19 pandemic on distance learning students led us to investigate how the disruption has affected the frequency with which they engage in their study activities.

In this study, we looked into the impact of the Covid-19 pandemic disruption on the studies of undergraduate students at The Open University (OU). The OU is an institution that has continued to develop its model of distance learning since its foundation in 1969. In recent years, its 'supported open learning' model has involved module materials delivered on a virtual learning environment (VLE), in alternative formats where required; use of a wide range of additional educational technologies for online learning; small (<20 learners) tutor group forums; online tutorials; regular tutor-marked assessment (TMA); feedback throughout modules; online management of the assessment; computer-marked assignments; either end of module assessments (EMA) (e.g. project, reports or dissertations) or face-to-face final exams; and extensive study and pastoral support through a variety of media (e.g. telephone, email, online, computer conferencing). On entering the first UK Covid-19 lockdown, the OU, therefore, had a high-quality, established online teaching and support capability; however, it was aware that many learners could be impacted by the pandemic and, more directly, that late Spring, in-person examinations would be impossible to deliver. Consequently, the university decided to cancel face-to-face exams and some of the EMAs for modules that had started in Autumn 2019. Grades were calculated using only the scores from the (typically five or six for a 60-point module) TMAs rather than, as usual, a combination of these scores with those from the EMA or final exams.

The case of the OU offers a unique opportunity to study the impact of Covid-19 on an established online distance learning HEI in the UK. Furthermore, the experience of distance learning students during the pandemic is relevant both to existing distance learning universities, and those borrowing teaching and learning practices from the distance and online sector. This study, therefore, has implications for how universities with new and existing distance learning practices address student challenges and support ongoing learning activity during Covid-19 and other disruptions.

2. Literature review

2.1. From face-to-face to online teaching

The Covid-19 pandemic has affected teaching and learning at almost all HEIs worldwide, with two-thirds reporting replacing classroom teaching with distance teaching and learning (Marinoni et al., 2020). Large-scale research involving 31,212 students

(Aristovnik et al., 2020) explored the means of delivering distance learning content among the HEIs of 62 countries and found that the most dominant form has been online lectures via real-time video conferences. This synchronous approach was followed by other asynchronous forms, such as sending presentations to students, video recording, written communication using forums and chats, and, more rarely, audio recording. This rapid shift from face-to-face to distance learning accommodated social distancing requirements and economic shutdowns caused by Covid-19 (Fernandez & Shaw, 2020; Watermeyer et al., 2020), but it did not come without significant challenges and costs.

The sudden and unexpected global shift to online teaching caused difficulties from several aspects: access to online systems, teacher and student competencies and pedagogies for distance learning, and the requirements of specific fields of study (Marinoni et al., 2020). For example, restricted internet access has presented major problems in low- to medium-resource countries such as India (Dutta, 2020) whilst Toquero (2020) describes the suspension of distance learning in the Philippines because HEIs were not prepared to implement online learning systems. Similarly, HEIs in countries with good internet connection reported financial difficulties in investing in tools and online licences (Marinoni et al., 2020). Regarding competencies and pedagogies, several HEIs discuss the implications of applying a different pedagogy for distant teaching and learning. While some institutions, such as the OU, have developed and applied pedagogical approaches for online learning and sought to develop solutions for subject-specific demands such as laboratories (http://stem.open.ac.uk/study/openstem-labs), staff in other HEIs have had to tackle this sudden shift with 'learning by doing' approaches or by transferring their face-to-face practices into distance-mode teaching (Marinoni et al., 2020). Overall, a successful transition from face-to-face to online teaching depends on the existing infrastructure, the capacity of teaching staff to adopt an online-teaching approach in their discipline, and understanding how students respond to and experience this transition.

2.2. Research on Covid-19 and higher education

2.2.1 Personal circumstances

A growing body of literature from campus-based universities has examined the impact of the unprecedented crisis of the Covid-19 pandemic and the first wave of lockdowns on student life, focusing on students' academic work, life and mental health issues. Aristovnik et al. (2020) have found that students' academic workload has been impacted, with a large percentage (43%) of the students reporting a significant increase. This finding corresponds with an increase of class workload reported by more than half of the study participants in Son et al. (2020) and one quarter in Aucejo et al. (2020). According to findings from Son et al. (2020), this sudden increase in workload derived mainly from students increasing their own efforts to catch up with modules without the in-person support they previously had from tutors and teaching assistants, proving their participation to their tutors by delivering more assignments than were requested before. Further, investigations into the challenges of studying at home suggest that difficulties in adopting studying habits may be the reason for feelings of work overload (Adnan & Anwar, 2020; Bao, 2020; Händel et al., 2020).

Bao (2020) also identifies an existing association between studying in isolation at home and an inappropriate learning environment and lack of self-discipline. Several studies indicate that a lack of ICT equipment (e.g. printers) at home and limited knowledge on its use, and even the lack of a quiet place to study are among the negative impacts of Covid-19. In particular, students in South America, Asia and Africa faced significant challenges with underdeveloped internet networks, and the mobile phone often their only available device for online learning (Adnan & Anwar, 2020; Demuyakor, 2020; Kapasia et al., 2020; Owusu-Fordjour et al., 2020). As mentioned earlier, poor internet access, on some occasions, has led to decisions to suspend or cancel some academic activities (Toquero, 2020), and has also made it difficult to provide students with equal learning opportunities, even in middle and high-income countries (Marinoni et al., 2020). Further, the closure of schools has also affected households, resulting in a larger demand on devices and the internet and causing emotional hardship to parents (Daniel, 2020; Garbe et al., 2020). Likewise, many households have experienced employment and financial issues due to Covid-19 (Brooks et al., 2020; Jena, 2020; Pan, 2020). Economic consequences were experienced by working students, too, as they reported decreases in salary, weekly hours and job offers (Aucejo et al., 2020; Kecojevic et al., 2020).

Moreover, during social distancing measures, institutional response and individual tutors played an important role in students' satisfaction and learning experience. Sahu (2020) notes that student satisfaction during Covid-19 was associated with new forms of learning provision, teaching support, sufficient information and support concerning exam procedures, and university communications. The importance of holding exams for finalising the semester, in particular, put much pressure on institutions to make rapid decisions because the first lockdown coincided with key assessment periods for universities (Burgess & Sievertsen, 2020). As a result, most of the universities planned to carry out semester exams through new measures, and others decided to cancel, alter or delay assessment (Marinoni et al., 2020). New forms of assessment, such as video vivas (Bisht et al., 2020), and graduation concerns (Aucejo et al., 2020) were identified as major factors in increasing mental pressure amongst students.

The heavy influence of Covid-19 social distancing measures on people's mental health around the globe (Brooks et al., 2020; Pan, 2020) has also affected university students. The reduced physical contact with other people, particularly fellow students in the case of face-to-face teaching at universities, may generate negative emotions such as boredom and anxiety (Brooks et al., 2020; Elmer et al., 2020; Ma & Miller, 2020). Several studies stress the negative impacts of studying at home on the emotional well-being of students unaccustomed to distance learning, reporting several reasons and outcomes. For example, student well-being issues were found to be positively associated with an inappropriate learning environment (Händel et al., 2020; Kecojevic et al., 2020), feelings of work overload (Aristovnik et al., 2020; Händel et al., 2020), employment loss (Kecojevic et al., 2020), career concerns (Aristovnik et al., 2020; Aucejo et al., 2020; Kecojevic et al., 2020), and concerns about physical health (Kecojevic et al., 2020; Son et al., 2020).

2.2.2 Socio-demographics and other student characteristics

The affected personal circumstances of students during this period are not necessarily just a reflection of the Covid-19 pandemic and its consequences, but also of some other, more permanent characteristics. For instance, findings from studies in multiple countries exploring

how socio-demographics influenced personal circumstances in various ways showed that female students reported to have a larger workload and were more concerned about their study and career than male students (Aristovnik et al., 2020). Moreover, they were more likely to engage less frequently with their studies, compared to male students (Aristeidou & Cross), and more likely to develop depression and anxiety disorder (Chirikov et al., 2020). However, female students were also found to be more comfortable with the online mode of learning (Bisht et al., 2020) and more satisfied with their work-life balance (Aristovnik et al., 2020). With regards to the level, field and mode of study, undergraduate students reported having larger workload and well-being issues compared to postgraduate students, part-time students were more worried about their personal finances and less satisfied with their work-life balance, full-time students were more concerned with study issues, applied sciences students were more satisfied with their work-life balance and art students reported having larger workloads (Aristovnik et al., 2020). Further, students who were already experiencing financial problems were more likely to develop depression and anxiety disorder (Aristovnik et al., 2020; Chirikov et al., 2020), delay graduation, and change their career preference (Aucejo et al., 2020). Finally, students with childcare and other caring responsibilities were more likely to develop depression and anxiety disorder (Chirikov et al., 2020).

In sum, research indicates that the Covid-19 pandemic may have profoundly impacted learners and their learning experience. However, most studies focus on the experiences of learners moving from face-to-face teaching modules, and there remains a need to understand further the perspective of students who are already familiar with online learning, working at home, and often managing a complex work-life-study balance.

3. Methods

3.1. Aims of this research

Research on how the Covid-19 pandemic has impacted the studies of campus-based students showed an overall disruption in their learning activities, with universities suddenly shifting from face-to-face to online teaching/learning (Section 2.1). This unexpected transition was not successful on many occasions due to a lack of infrastructure, staff capacity, and student response (Marinoni et al., 2020). On the contrary, students in distance learning universities are already familiar with online learning and own the technology required for their studies. However, the experience of distance learning students with regard to their study habits during the pandemic has not been reported. This lack of empirical basis for insights into distance learning students' habits during the pandemic motivated us to explore whether engagement in main study activities had been impacted. We investigated this with the following research question (RQ):

> (1) What was the perceived change in duration spent on learning, assessment and social activities that students commonly undertake during a module at the OU?

Further to examining an overall disruption in the study activities of campus-based students, several studies (Section 2.2.) sought to explain the factors that affected this disruption. The factors revealed involve socioeconomic characteristics, student characteristics, personal circumstances, and lack of interaction with others. These factors are not directly related to students' studies and can be associated with distance learning students,

too. In order to explore the potential effects of these factors, and the disruption of the OU students' studies (cancellation of face-to-face exams) on their study habits, we investigated the following RQ and associated null hypotheses:

(2) What are the main predictors of negative impacts on the study habits (learning, assessment and social activities) of OU students during a pandemic, such as Covid-19, and their relative influence?

H_0 1: There will be no significant prediction of negative impacts on OU students' study habits during the pandemic by socio-demographics, student characteristics, personal circumstances, lack of interaction, and disruption of exams.

H_0 2: In the presence of others, there will be no significant prediction of negative impacts on OU students' study habits, during the pandemic, by:

a: their socio-demographics (gender, age, race and socioeconomic background)

b: their student characteristics (discipline and module start)

c: their Covid-19 personal circumstances (employment, caring responsibilities, financial concerns, personal health, internet access and access to devices)

d: their interaction frequency with others (staff and other students)

e: the disruption of their exams (satisfaction with progress and changes to assessment)

These questions and hypotheses helped us address the lack of existing literature on the impact of the Covid-19 pandemic on the learning experience of distance learning students in HE. In particular, findings contributed to our understanding of the student-perceived change in duration spent on their learning activities; and which factors related to negative impacts, if any. Further, this study enriches literature on how the Covid-19 disruption has impacted higher education, by adding insights into how distance learning universities were influenced.

In order to answer the questions and hypotheses, a survey was administered to OU undergraduate students. The survey included a list of learning activities commonly undertaken during a module; students were invited to report their perceived change in duration spent on these activities (RQ1). Descriptive statistics and visualisations were used to analyse and interpret the findings. Further, students were asked, via closed-ended questions, about their personal characteristics and circumstances that may have impacted their learning experience during the pandemic (see RQ2, H_0 2 a-e). A binary logistic regression analysis was performed to investigate the effect of these factors on negative impacts (if any) on OU students' learning activities. The following sections explain in detail our methods.

3.2. Participants and recruitment

For the current study, we recruited active OU undergraduate students to take part in an online survey. Ethical approval was obtained from the authors' university ethics committee, and participation in the survey was voluntary. The survey was administered over July-

August 2020 to students of the Curriculum Design Panel (sample: approx. 2,000) and a random university-wide sample of students (sample: 2,500). Before completing the survey, the respondents were provided with an online information sheet and a consent form. The dataset was anonymised on 30 August 2020, prior to initiating the process of data analysis.

3.3. Study activities

To explore the impact on the academic workload of OU students, we developed a list of study activities that students commonly undertake during a module. The activities were formed based on a list of items developed and iterated over three surveys of OU learners' use of handheld technologies (Cross et al., 2019). These items had been mapped against Conole's (2012) learning activity categories to ensure coverage across assimilative, communicative, information handling and productive activity domains and repeatedly piloted and tested with distance learners. Cross et al. (2019) highlighted the degree of social media use for non-study purposes but did not ask for study purposes. This was an omission that we remedied with an addition to the list in the present study. Furthermore, whilst Cross et al. (2019) asked about the preparation of assessment and revision (the latter being particularly relevant to the point in learners' study at which the lockdown began), we added items about access and use of feedback and marks because these are central activities to the university's assessment model and would work well with the response scales used. The items included in the list were reviewed and agreed with experts in the OU's Quality Enhancement and Innovation Team (which included the group responsible for the OU's Student Experience of Feedback, Assessment and Revision Survey) and reviewed again, after the draft survey was piloted, with a standing panel of student volunteers (n = 201).

The study activities formed three self-report frequency scales designed to measure the students' self-perceived frequency change in undertaking certain learning activities: (a) the 7-item learning activity scale; (b) the 6-item assessment activity scale; and (c) the 4-item social activity scale. Likert scale responses ranged from 1 (much less frequently) to 5 (much more frequently). The score for each survey respondent equalled the mean score of the responses. Reliability analyses were carried out on the learning, assessment and social activity frequency scales. Cronbach's alpha showed the scales to reach acceptable reliability, with $\alpha = .93$ for the learning activity scale, $\alpha = .92$ for the assessment activity scale, and $\alpha = .85$ for the social activity scale.

In the first phase of analysis, visualisations of the frequency scales and descriptive statistics were used to answer RQ1 and describe the impact on the frequency by which OU students were undertaking learning, assessment and study activities. Percentages of participants were presented for each frequency selection, and items were presented in order of negative impact on the frequency of undertaking a particular learning activity. Data presented in Q1 include all 555 responses received. Table 1 shows the demographics, age and discipline information that was available for all the survey respondents. Disciplines included Social Sciences and Humanities (FASS); Science, Technology, Engineering and Maths (STEM); Education, Languages, Health and Sport Studies (WELS); Business and Law (FBL). Entry-level modules and open degrees students are not assigned to a particular discipline but were included in this study for comparison.

Table 1. Demographics, age and discipline (N = 555).

Demographics	Total *n*	%	Total Discipline	*n*	%
Gender			FASS	216	39
Female	344	62	STEM	157	28
Male	198	36	WELS	81	15
No answer	13	2	FBL	59	11
All	555	100	Entry level	13	2
			Open degree	13	2
Age			Not sure	4	1
Under 25	66	12	No answer	12	2
26–35	148	27	All	555	100
36–45	136	25			
46–55	96	17			
56 or over	97	17			
No answer	12	2			
All	555	100			

[Table 1 here]

3.4. Predictors of negative impact

In relation to RQ2, we expected that the successful prediction of negative impact could be achieved with the following student information:

(a) Socio-demographics: gender, age, race, socioeconomic status (SES), socioeconomic group (SEG) and Index of Multiple Deprivation (IMD). Race information was summarised in Black, Asian and minority ethnic (BAME) and non-BAME students.

(b) Student characteristics: discipline and when the module has started (presentation). Presentation was summarised in modules starting in October 2019 (2019J) and February 2020 (2020B).

(c) Covid-19 personal circumstances that had a medium to high impact on the study of OU students: employment, volunteering, childcare, other caring, financial concerns, personal health, declared disability, internet access, access to devices.

(d) Covid-19 outcomes concerning their interaction frequency with OU staff/tutors and other students, their satisfaction with their overall progress, and the OU changes to TMAs and end-of-module assessment EMAs.

A binary logistic regression analysis was performed to examine which of the characteristics and Covid-19 circumstances explain a negative impact on the frequency by which OU undergraduate students were undertaking learning, assessment and social activities. Our unit of analysis was students *(n = 269)*, of which we had a complete description of their characteristics and Covid-19 circumstances. The dichotomous dependent variable was calculated based on the mean score of each respondent in each frequency scale, with average scores of 1 or 2 (students undertaking study activities less or much less frequently) for 'negative impact' and 1, 2 or 3 for 'positive or no impact'.

Table 2 presents descriptive statistics of the variables entered in the model. In categorical variables with more than two options, reference categories are indicated in the dependency model (Table 3 – Appendix 1). Correlation analysis was performed before entering the variables into the regression to examine for multicollinearity. No variables

were found to correlate highly or significantly. Nagelkerke R^2 (Allison, 1999) was used to characterise the relationship between prediction and grouping. Associations between the negative impacts on OU students and the independent variables in our dependency model (Table 3 – Appendix 1) were estimated using odds ratios (ORs) as produced by

Table 2. Descriptive statistics (%) for categorical data entered in the regression model (n = 269).

CHARACTERISTICS			
Gender		**IMD Code**	
Female	173 (64%)	0–25%	52 (19%)
Male	96 (36%)	25–50%	61 (23%)
		50–75%	76 (28%)
Age		75–100%	80 (30%)
Under 25	34 (13%)		
26–35	78 (29%)	**SEG**	
36–45	65 (24%)	High	248 (92%)
46–55	46 (17%)	Low	21 (8%)
56 or over	46 (17%)		
		SES	
Discipline		Not low	252 (94%)
STEM	73 (27%)	Low	17 (6%)
WELS	51 (19%)		
FASS	110 (41%)	**BAME**	
FBL	25 (9%)	Yes	11 (4%)
Entry level	10 (4%)	No	258 (96%)
COVID-19 CIRCUMSTANCES			
Employment		**Personal health**	
Medium/High	131 (49%)	Medium/High	104 (39%)
Low/No impact	138 (51%)	Low/No impact	165 (61%)
Childcare		Mental health	
Medium/High	96 (36%)	Medium/High	151 (56%)
Low/No impact	173 (64%)	Low/No impact	118 (44%)
Other caring responsibilities		**Declared disability**	
Medium/High	65 (24%)	Medium/High	29 (11%)
Low/No impact	204 (76%)	Low/No impact	240 (89%)
Financial concerns		**Internet connection**	
Medium/High	87 (32%)	Medium/High	42 (16%)
Low/No impact	182 (68%)	Low/No impact	227 (84%)
Volunteering		**Access to devices**	
Medium/High	39 (14%)	Medium/High	45 (17%)
Low/No impact	230 (86%)	Low/No impact	224 (83%)
SATISFIED WITH			
Workload Management		**TMA changes**	
Yes/No change	182 (68%)	Yes/No change	232 (86%)
No	87 (32%)	No	37 (14%)
Online tutorials		**EMA changes**	
Yes/No change	235 (87%)	Yes/No change	216 (80%)
No	34 (13%)	No	53 (20%)
Tutor			
Yes/No change	243 (90%)		
No	26 (10%)		
INTERACTION FREQUENCY WITH			
Tutor		**Other students**	
Less frequently	83 (31%)	Less frequently	95 (35%)
Same or more	186 (69%)	Same or more	174 (65%)
STUDY ACTIVITIES			
Learning activities		**Assessment activities**	
Negative impact	159 (59%)	Negative impact	60 (22%)
Positive or no impact	110 (41%)	Positive or no impact	209 (78%)
Social activities			
Negative impact	71 (26%)		
Positive or no impact	198 (74%)		

the logistic regression procedure in SPSS (Version 25). The ORs were used to explain the strength of the presence or absence of significant negative impact. Wald tests were used to assess the significance of each predictor.

[Table 2 here]

4. Results

4.1. Impact on study activities

This section answers RQ1: *What was the impact of the disruption on the study habits of distance learning students?*

The data *(n = 555)* show the very different effects the pandemic has had on student learning. Approximately 42% of learners reported experiencing a negative impact on the frequency with which they undertook learning activities; however, 14% reported a positive impact. Joining synchronous online tutorial sessions was the most negatively impacted, with 49% engaging in this activity less or much less frequently (RQ1: perceived change in duration spent on learning, assessment and social activities). Most positively impacted was the information handling activity of searching for information on the internet (20% positive impact) although the complementary item – searching for academic reports or papers – was less positively impacted.

[Figure 1 here]

Half of all learners reported a negative impact on the time they spent revising module content, whilst a minority reported a positive impact on revision-based activities. Furthermore, 44% of learners reported reducing the frequency of activity relating to preparing their TMA assignments. The download and use of feedback from assignments (provided after every assignment by tutors) was impacted less. On average, the assessment activities of around 33% of students had been negatively impacted, and 12% had been positively impacted.

[Figure 2 here]

Activities associated with student-to-student learning and interaction appear to have been negatively impacted for around 32% of students, whilst for others (18%), Covid-19 had provided an opportunity to increase social interaction. Accessing OU forums was the

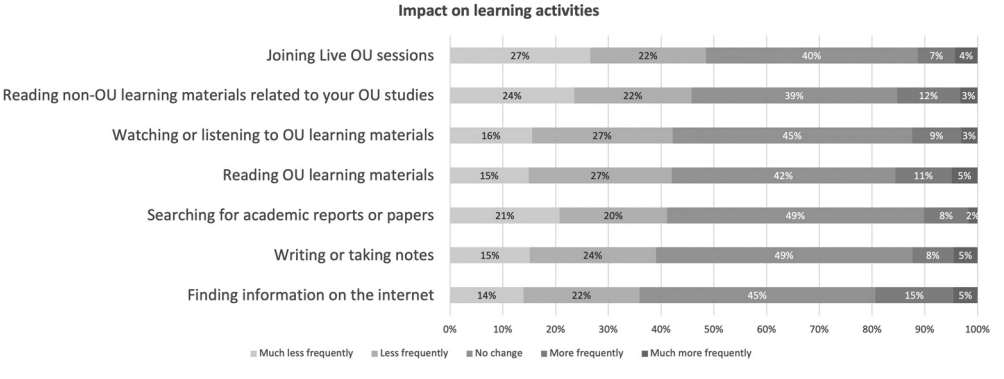

Figure 1. Participants' rating in order of negative impact on the frequency of undertaking a learning activity.

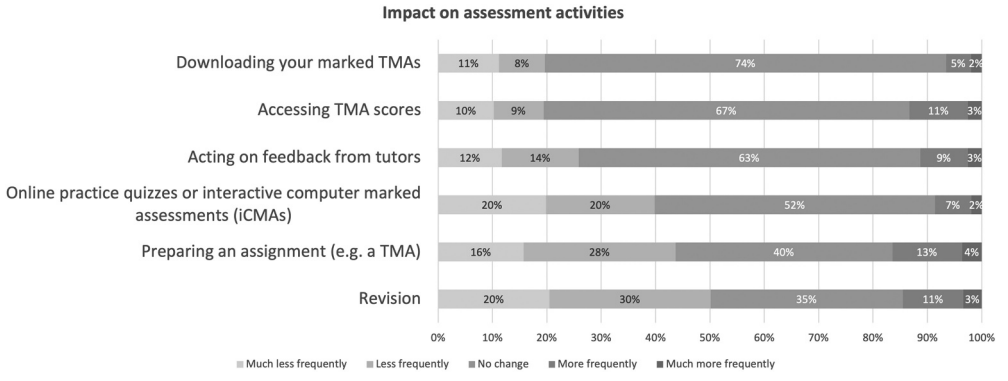

Figure 2. Participants' rating in order of negative impact on the frequency of undertaking an assessment activity.

activitiy with the highest negative impact (36%), which may have negatively impacted any forum-based and peer-learning activity within modules. Accessing email for study purposes had the lowest negative impact (27%). A greater proportion of learners (30%) used social media for social interaction unrelated to study than did for social interaction related to it (14%).

[Figure 3 here]

Overall, a negative impact on undertaking study activities was reported by more than one-third (36%) of the respondents, while only 15% of them had experienced a positive impact. In the following section, we discuss the causes of negative impact.

4.2. Predictors of negative impact

This section answers RQ2: *What are the main predictors of negative impact on the study habits of OU students during a pandemic, such as Covid-19, and what is their relative influence?*

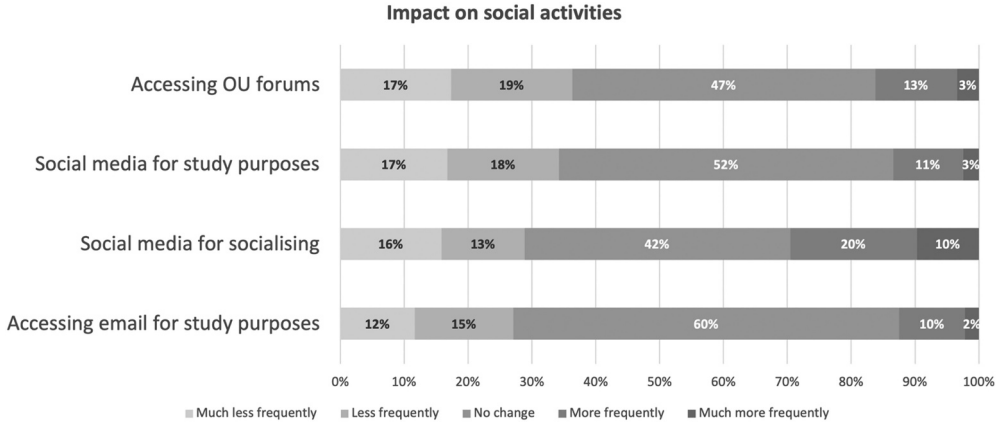

Figure 3. Participants' rating in order of negative impact on the frequency of undertaking a social activity.

For predicting negative impacts on study habits, tests of the full model against a constant only model were statistically significant, indicating that the predictors as a set reliably distinguished between OU students with negatively impacted study habits. Prediction success for learning activities was 82.5% (88.1% for positive or no impact and 74.5% for negative impacts); for assessment activities, 86.2% (94.3% for positive or no impact and 58.3% for negative impact); and for social activities, 80.7% (90.9% for positive or no impact and 52.1% for negative impact). Therefore, we reject the H_0 1 hypothesis (*there will be no significant prediction of negative impacts on OU students' study habits during the pandemic by socioeconomic characteristics, student characteristics, personal circumstances, lack of interaction, and disruption on exams)*. Table 3 (see Appendix 1) presents the results of the logistic regression models estimating the effects of independent variables on predicting negative impacts on the learning, assessment and social activities of OU students.

The Wald criterion demonstrated that two variables – managing workload and less frequent interaction with students – made significant contributions to predicting study activities across the three models. OR values indicated that OU students who were dissatisfied with managing their workload were eight times more likely to experience a negative impact on their learning activities than those who were not and four times more likely to experience a negative impact on their assessment and social activities. Our findings on workload corroborate those of campus-based universities (e.g. Aristovnik et al., 2020; Son et al., 2020). Interestingly, students at the OU with less frequent interaction with other students, as a result of the disruption, were four times more likely to experience a negative impact on their learning activities, six times more on their assessment activities, and three times more on their social activities. OU learners comprise a diverse group of students, and the choice of distance learning may reflect a predisposition for independent learning as much as for social and peer learning. However, data reported in the previous section indicate distinct changes in habits for many. As a consequence, self-isolation, a change in studying habits, and other circumstances reported by campus-based universities (Bao, 2020) may also have had an impact on the academic work of OU students.

Socioeconomic factors, such as SEG and the IMD of students, made significant contributions to predicting a negative impact on assessment activities, and to a smaller extent, learning activities. Those of a lower SEG were 16 times more likely to have reported negative impacts on their assessment activities than those of a higher SEG. Moreover, compared to those belonging to the 75–100% IMD, students of 50–75% IMD were 13 times more likely to have experienced a negative impact on their assessment activities and students of 25–50% four times. With regards to learning activities, students of 0–25% IMD, compared to those belonging to the 75–100% IMD, showed a significantly lower negative impact (OR = .227). Although previous research emphasises students' mental health and financial concerns in lower SEG (e.g. Aristovnik et al., 2020; Aucejo et al., 2020; Chirikov et al., 2020), it has not yet examined assessment-related effects. Our findings clearly show how students from lower socioeconomic backgrounds reported a much greater negative impact on their assessment activities.

As raised by previous research (e.g. Brooks et al., 2020; Garbe et al., 2020; Kecojevic et al., 2020), personal circumstances were also indicated as important factors in predicting a negative impact on OU learning and assessment activities. Students with employment

concerns were three times more likely to have experienced a negative impact on their learning activities, and those with childcare responsibilities were two and a half times more likely than those without. Negative impacts on assessment activities were predicted by a set of different personal circumstances, with students having other caring responsibilities and personal health issues to be impacted 3.5 times more than those without. While there is no direct comparison with students in campus-based universities, it is expected that OU students (of whom the majority are over 25 years old) are more associated with parental or grandparental childcare and other caring responsibilities, employment issues, and health concerns.

Other variables that were significant at predicting negative impacts on study activities were less frequent tutor interaction for learning activities, module level, the time of presentation for assessment activities, and age for social activities. Those who had less frequent interaction with their tutors were three times more likely to have had negative impacts on their learning activities. This finding substantiates previous findings in the literature that highlight the role of tutors in maintaining students' learning experience (e.g. Sahu, 2020). Regarding module level, while the various disciplines (Levels 1–3) seemed to show little significant difference across the three models, students studying introductory access modules (Level 0) of any discipline were 14 times less likely to engage in assessment activities compared to the least affected (WELS students). Access modules differ in some respect to standard undergraduate qualification modules in terms of funding, support and content, partly explaining the difference. There is insufficient evidence to determine whether this is a consequence of increased well-being issues in students at lower university levels (Aristovnik et al., 2020). In relation to the time presentation of the module, ORs indicated that OU students in modules that started in October 2019 (2019 J presentation) whose EMA was to take place in May 2020, were four times more impacted than those with a February 2020 module start (2020B presentation), with EMA later in the year. This result may be a consequence of the fast decisions taken by the university in line with those taken elsewhere in the sector (Burgess & Sievertsen, 2020; Marinoni et al., 2020). Finally, OR values indicated that younger students, aged under 25, had four and a half times more negative impact on their social activities than older students. The reasons for this result are not yet completely understood.

Our results showed that we reject the null hypotheses 2a-2e (in the presence of others, there will be no significant prediction of negative impacts on OU students' study habits, during the pandemic, by socioeconomic characteristics/student characteristics/Covid-19 personal circumstances/interaction frequency with other/disruption of exams). One or more predictors in each hypothesis was statistically significant to the model. In the following section we aim to discuss and understand the importance of these predictors.

5. Discussion

Our findings indicated a 36% overall negative impact on the frequency with which OU students were undertaking study activities (RQ1). This negative impact mainly associates with difficulties in managing workload and limited interaction with other students (Table 2). While study workload issues in campus-based universities are attributed to difficulties in adapting new studying habits (Adnan & Anwar, 2020; Händel et al., 2020), it can also be

explained by well-being issues (Händel et al., 2020; Kecojevic et al., 2020) or other circumstances that characterise older students, such as increased childcare responsibilities (Garbe et al., 2020). What is surprising is the fact that interaction with other students at a distance learning university made a significant contribution to the prediction of negative impact across all three study categories. A possible explanation for this unexpected outcome may be the many collaborative distance study activities, which may fail to work when students opt out due to other life concerns (employment issues, childcare and other caring responsibilities) or personal health concerns, as presented in Table 3. While these two factors (workload management and interaction with other students) explained negative impact across the three study categories, other factors were related to more particular ones.

Interestingly, the most affected study items were revision (Figure 2) followed by joining live OU sessions (Figure 1). The university's decision to cancel EMA may explain why 50% of learners reported negative impacts on time spent revising. Revision can form an important stage in module learning consolidation (Cross et al., 2016), so removing the exam may have impacted the amount of reflective learning occurring. That some learners found more time for revision perhaps indicates that the conditions created by the pandemic helped some find more time to initiate self-reflection even in the absence of an EMA or final exam. Many learners (44%) reported a reduction in the time spent writing assignments. This finding may be surprising given that final grades were based only on assignment marks (because final exams had been cancelled). However, unlike in other contexts, such as those studies finding campus-based students reporting an increased engagement with requested assignments to prove their participation (Son et al., 2020), OU learners would already have completed the majority of the in-module assessment before the lockdown. Therefore, impact on writing assessments may indicate reduced ability to commit time to assessment or that some students had secured the required scores on previous assignments to achieve the average they were seeking.

These findings may not be surprising if we consider that different challenges characterise each student group; for instance, campus-based students are challenged by new online learning and assessment approaches, while distance learning students may be challenged more by life-related difficulties. Overall, as suggested in campus-based studies, socioeconomic factors (e.g. Aucejo et al., 2020; Chirikov et al., 2020) and study level (e.g. Aristovnik et al., 2020) were found to be associated with negative impacts on OU student study activities too, and in particular on assessment-related activities.

The high negative impact on *joining live tutorial sessions* will need to be investigated further. It may, in part, be attributable to less interest or ability of some to spend time on TMAs, the cancellation of EMA or changes in personal circumstances (Table 2). Employment issues and childcare responsibilities are linked to a change in students' routines (e.g. Brooks et al., 2020; Garbe et al., 2020; Kecojevic et al., 2020), which obstructs regular study activities and reduces available time. This routine disruption could explain a negative impact on undertaking learning activities and on interaction with tutors. It could also indicate a need to reassess the timing of tutorial sessions (greater variety across the day) and the use of re-watchable recordings.

Overall, no significant differences in negative impacts were observed between students of different genders or discipline areas, as we might have expected from previous research (e.g. Aristovnik et al., 2020). Further, while a significant proportion of students

reported their study activities to be highly impacted by mental health issues (Table 2), this factor did not significantly contribute to predicting negative impacts on study activities. Therefore, this study has not confirmed previous research reporting well-being issues to be positively associated with academic work issues (Aristovnik et al., 2020; Händel et al., 2020). These differences can be accounted for in part by personal circumstances that characterise the OU students, including their long experience of studying online.

These observations have several implications for research into disrupted teaching and learning. This work has revealed that a switch from face-to-face to online learning can be a feasible solution in times of disruption, but it is not quite as simple to reach its maximum value without further investigation into the details surrounding students' current situation and background. The present findings might suggest several courses of action to solve this issue and support policymakers in designing distance learning activities that best suit student needs during disruption. Such actions may involve the development of more asynchronous learning activities that allow students to engage at a time of their choice, the design of more accessible and handier technologies for student interaction, or the creation of assessment alternatives that promote revision and reflection (e.g. asynchronous timed exams or open-book assessment).

Although our study enhances our understanding of Covid-19 effects on distance learning students' study habits, it is plausible that a number of limitations could have influenced the results obtained. First, the sample is comprised of undergraduates who are studying in one distance learning university. While the population of this study fall into different socio-demographic categories and are enrolled in modules of different disciplines and levels, they have all experienced changes, advice and support from a single university. Second, our survey data are based on self-report and may be subject to unconscious biases (i.e. participants not assessing themselves or the situation accurately). Finally, as this is a cross-sectional study during the first Covid-19 lockdown, findings need to be interpreted with caution and in relation to the particular setting. Future studies should also capture the factors that influence the mental health of distance learning students and further assess the role of different student aspects.

6. Conclusions

Our findings support the notion that the current Covid-19 pandemic has a significant negative impact on the study habits of students in distance learning institutions. While the learning habits of distance learning students are disrupted less when compared to those of campus-based students, the pandemic has still impacted their study habits, life and mental health and has intensified already existing problems. Further research is needed specifically about the negative consequences associated with poor study habits (e.g. assessment failure and graduation delays). Additional studies investigating the effect of the pandemic on study workload and student interactions may provide a better understanding of how to provide students with proactive support during disruptions.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Appendix 1

Table 3. Logistic regression models estimating effects of independent variables on negative impact (n = 269).

Variable	Learning					Assessment					Social				
	B	S.E.	Wald	*p* value	Exp(B)	B	S.E.	Wald	*p* value	Exp(B)	B	S.E.	Wald	*p* value	Exp(B)
Female	.838	.434	3.726	.054	2.312	.523	.521	1.006	.316	1.687	.365	.437	.697	.404	1.44
Age															
56 or over (ref)			1.456	.834				4.856	.302				4.857	.302	
46–55	.753	.685	1.209	.271	2.124	.682	.777	.769	.380	1.977	1.338	.720	3.455	.063	3.810
36–45	.491	.706	.484	.487	1.634	.338	.811	.174	.677	1.402	1.372	.746	3.379	.066	3.943
26–35	.543	.638	.725	.395	1.721	−.167	.749	.050	.823	.846	1.165	.695	2.812	.094	3.207
Under 25	.712	.722	.973	.324	2.038	−1.219	.968	1.585	.208	.295	1.547	.763	4.108	.043*	4.697
Discipline area															
WELS (ref)			1.591	.810				7.223	.125				2.827	.587	
STEM	−.399	.558	.511	.475	.671	−.587	.652	.811	.368	.556	−.096	.544	.031	.860	.909
FASS	0	.494	0	1.00	1.00	−.257	.561	.210	.647	.774	−.399	.485	.678	.41	.671
FBL	−.694	.729	.907	.341	.500	.343	.770	.199	.656	1.409	−1.001	.699	2.051	.152	.367
Entry level	.135	1.125	.014	.904	1.145	2.634	1.280	4.232	.040*	13.926	.383	1.086	.125	.724	1.467
Low SEG	2.011	1.245	2.608	.106	7.472	2.765	1.254	4.863	.027*	15.871	1.268	1.113	1.299	.254	3.554
Low SES	−.667	1.193	.312	.576	.513	−2.600	1.369	3.609	.057	.074	−.391	1.131	.120	.730	.676
IMD															
75–100% (ref)			9.571	.023*				18.508	<.001***				5.676	.128	
0–25%	−1.483	.713	4.333	.037*	.227	.148	.845	.031	.861	1.159	−.199	.684	.085	.771	.820
25–50%	.767	.524	2.142	.143	2.154	1.460	.678	4.637	.031*	4.304	.911	.545	2.797	.094	2.486
50–75%	.285	.477	.357	.550	1.330	2.597	.651	15.888	<.001***	13.419	.891	.489	3.324	.068	2.437
BAME	1.128	.984	1.313	.252	3.089	1.565	.903	3.001	.083	4.783	.531	.843	.397	.529	1.701
2019 J presentation	.666	.571	1.356	.244	1.946	1.478	.725	4.152	.042*	4.385	−.222	.552	.161	.688	.801
Dissatisfaction with															
Online tutorial opportunities	−.931	.591	2.488	.115	.394	1.013	.583	3.024	.082	2.754	.703	.541	1.686	.194	2.020
Managing workload	2.084	.439	22.557	<.001***	8.036	1.428	.459	9.656	.002**	4.169	1.370	.397	11.939	.001**	3.936
Tutor support	.365	.708	.266	.606	1.440	−1.280	.882	2.104	.147	.278	.611	.673	.824	.364	1.841
TMA changes	1.153	.690	2.791	.095	3.166	.325	.752	.187	.666	1.384	.593	.619	.920	.337	1.810
EMA changes	−.646	.549	1.388	.239	.524	−.816	.603	1.828	.176	.442	.277	.515	.288	.591	1.319
Less frequent interaction with other students	1.385	.405	11.695	.001**	3.993	1.790	.457	15.349	<.001***	5.989	1.162	.390	8.860	.003**	3.197

(*Continued*)

Table 3. (Continued).

Variable	Learning					Assessment					Social				
	B	S.E.	Wald	*p* value	Exp(B)	B	S.E.	Wald	*p* value	Exp(B)	B	S.E.	Wald	*p* value	Exp(B)
Female	.838	.434	3.726	.054	2.312	.523	.521	1.006	.316	1.687	.365	.437	.697	.404	1.44
Less frequent interaction with tutor	1.033	.421	6.028	.014*	2.808	.260	.454	.328	.567	1.297	.406	.405	1.005	.316	1.501
Highly impacted because of															
Employment	1.105	.416	7.046	.008**	3.021	−.083	.486	.029	.864	.920	.104	.410	.064	.800	1.109
Volunteering	−.247	.542	.208	.648	.781	0.29	.598	.234	.628	1.336	−.244	.525	.216	.642	.783
Childcare	.911	.460	3.927	.048*	2.486	−.027	.547	.002	.961	.973	.292	.449	.423	.515	1.34
Other caring	.773	.450	2.947	.086	2.165	1.18	.494	5.714	.017*	3.255	.587	.420	1.955	.162	1.798
Financial concerns	−.381	.450	.716	.398	.684	−.593	.501	1.401	.237	.553	−.010	.428	.001	.981	.990
Personal health	.823	.429	3.692	.055	2.278	1.290	.490	6.946	.008**	3.634	.644	.423	2.317	.128	1.904
Mental health	.323	.438	.543	.461	1.381	.545	.528	1.066	.302	1.724	−.182	.445	.167	.683	.834
Declared disability	−.578	.582	.986	.321	.561	−.099	.632	.025	.875	.906	−.215	.562	.146	.702	.807
Internet	−.661	.564	1.372	.241	.516	−.915	.667	1.885	.170	.400	−.043	.550	.006	.938	.958
Access to devices	−.219	.536	.167	.683	.803	.088	.626	.020	.888	1.092	.279	.544	.262	.609	1.321
Constant	−4.781	1.118	18.284	<.001***	.008	−6.787	1.483	20.956	<.001***	0.001	−4.583	1.132	16.38	<.001***	0.01

Note. ref = reference category; * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$; Model fit Learning LR = 146.410 df = 33 $p < .001$ Nagelkerke $R^2 = 0.566$; Model fit Assessment LR = 93.732 df = 33 $p < .001$ Nagelkerke $R^2 = 0.542$; Model fit Social LR = 117.754 df = 33 $p < .001$ Nagelkerke $R^2 = 0.430$.